REMARKS

Claims 1-34

In the Office Action dated March 6, 2006, claims 1-34 have been rejected under 35 USC 103(a) as being unpatentable over Pinarbasi (US2003/0179513) in view of Saito et al. (US2003/0011948).

The analysis of obviousness was set forth in *Graham v. John Deere*, 383 U.S. 1, 148 USPQ 459 (1966). In order to establish a *prima facie* case of obviousness, three basic criteria must be met:

> First, there must be some *suggestion or motivation*, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the teachings of the references. Second, there must be a *reasonable expectation of success*. Finally, the prior art reference or combined references must teach or suggest *all the claim limitations*. *The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art*, and not based on applicant's disclosure (*In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991; emphasis added).

Applicants respectfully believe that the amendment to the claims has overcome the rejection under the *Graham* test. Specifically, the amendments to the claims cause the combination of references proposed in the rejection to fail the first and third elements of the *Graham* test.

The requirement of the third element is clear: the prior art reference or combined references must teach or suggest *all the claim limitations*. To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. *In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970).

Claims 1-34 require that the antiparallel pinned layers have about identical thicknesses. Support for this amendment is found in FIGS. 7-12, for example. In sharp contrast, Pinarbasi's AP pinned layers have AP pinned layers of very different thicknesses. See, for example, Pinarbasi FIGS. 10 and 11. Likewise, Saito teaches and suggests that the AP pinned layers have different thicknesses that are not about identical. Consider the following quote from Saito, which was also cited in the rejection:

> **[0017]** The direction of magnetization of the first pinned magnetic layer **112** is anti-parallel to the direction of magnetization of the second pinned magnetic layer **114,** and the magnetic moment of the first pinned magnetic layer **112** cancels the magnetic moment of the second pinned magnetic layer **114.** However, since the thickness tP_1 of the first pinned magnetic layer **112** is slightly larger than the thickness tP_2 of the second pinned magnetic layer **114,** a few magnitude of spontaneous magnetization remains due to the contribution of the first pinned magnetic layer **112** to leave the pinned magnetic layer **104** to be in a ferrimagnetic state. This spontaneous magnetization is further amplified by the exchange coupling magnetic field with the antiferromagnetic layer **103** to fix the direction of magnetization of the pinned magnetic layer **104** toward the Y-direction. (*emphasis added*)

See also, Saito paragraph [0192]. Accordingly, it can be appreciated that Saito only suggests pinned layers having different thicknesses. It follows that Saito cannot suggest modification of Pinarbasi to have pinned layers of substantially identical thickness. Because not all claim limitations 1-34, particularly as amended, would be improper as failing the third element of the *Graham* test. Reconsideration and allowance of claims 1-34 is respectfully requested.

Regarding the first prong of the *Graham* test in relation to claims 1-34, both Pinarbasi and Saito teach away from AP pinned layers having nearly identical thickness. A *prima facie* case of obviousness may also be rebutted by showing that the art, in any material respect, teaches away from the claimed invention. *In re Geisler*, 116

F.3d 1465, 1471, 43 USPQ2d 1362, 1366 (Fed. Cir. 1997) (emphasis added). It is improper to combine references where the references teach away from their combination. *In re Grasselli*, 713 F.2d 731, 743, 218 USPQ 769, 779 (Fed. Cir. 1983). As noted above, Pinarbasi discloses pinned layers of differing thicknesses. Likewise, Saito states several times that the first and second pinned layers have different thicknesses. *See inter alia*, Saito [0017, 0192]. Accordingly, the references themselves teach that the thicknesses of AP pinned layers should be different. Thus, it cannot be said that either reference suggests the combination of features proposed in the rejection. For this reason as well, any rejection based on Pinarbasi and Saito would fail the *Graham* test. Reconsideration and allowance of claims 1-34 is respectfully requested.

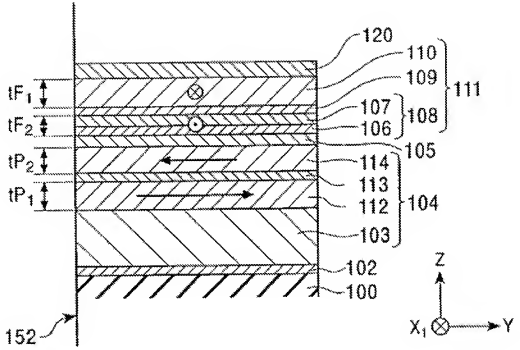
Additionally regarding the third element of the *Graham* test in relation to claims 9-34, claims 9-34 have also been amended to require that the net magnetic moment of the AP pinned layer structure is substantially equal to zero. As conceded in Section 2 of the Office Action, Pinarbasi does not state that the net magnetic moment of the pinned layer structure equals about zero, much less substantially equal to zero. Saito has been added to provide this feature. However, upon closer examination of Saito, it appears that Saito actually teaches AP pinned layer structures that have a net magnetic moment that is purposely made to have some meaningful magnitude greater than zero. The rejection points to paragraph 0017 of Saito, reproduced immediately below.

> **[0017]** The direction of magnetization of the first pinned magnetic layer **112** is anti-parallel to the direction of magnetization of the second pinned magnetic layer **114**, and the magnetic moment of the first pinned magnetic layer **112** cancels the magnetic moment of the second pinned magnetic layer **114**. However, since the thickness tP_1 of the first pinned magnetic layer **112** is slightly larger than the thickness tP_2 of the second pinned magnetic layer **114**, a few magnitude of spontaneous magnetization remains due to the contribution of the first pinned magnetic layer **112** to leave the pinned magnetic layer **104** to be in a ferrimagnetic state. This spontaneous magnetization is further amplified by the exchange coupling magnetic field with the antiferromagnetic

> layer **103** to fix the direction of magnetization of the pinned magnetic layer **104** toward the Y-direction. (*emphasis added*)

As noted, the thicknesses of the pinned magnetic layers are made different, giving an overall net magnetic moment that does not equal zero, as net magnetic moment is a function of thickness of the magnetic material. Particularly, the thickness of the first pinned layer 112 is greater than the thickness of the second pinned layer 114 so that not only does the magnetic moment of the first pinned magnetic layer cancel out the magnetic moment of the second pinned layer, but also provides "a few magnitude of spontaneous magnetization," in other words, a net magnetic moment of some magnitude greater than zero. This assertion is proven when viewing Saito's FIG. 30 (reproduced below), which shows the arrows representing the magnetizations of pinned layers 112 and 114 as being of different magnitudes, thereby indicating that the pinned layer structure 112/113/114 has a net magnetic moment much greater than about zero.

FIG. 30
PRIOR ART



The other embodiments disclosed in Saito likewise have AP pinned layer structures having net magnetic moments purposely made to be greater than about zero. Note, *inter alia*, Saito's FIGS. 2, 8, 10 and 12.

Additionally, Saito indicates that the pinned layer structure is in a ferrimagnetic state in paragraph 0017. A "ferrimagnetic state" is referred to in Saito paragraph 0030 in relation to the free layer as satisfying the relationship $M_1t_1 > M_2t_2$. This relationship requires a net magnetic moment that does not equal about zero. A definition of ferrimagnetic is: noting or pertaining to a substance, as a ferrite, in which the magnetic moments of some neighboring atoms point in opposite directions, with a net magnetization still resulting because of differences in magnitudes of the opposite moments. [Source: *Random House Unabridged Dictionary*, Copyright © 1997, by Random House, Inc., on Infoplease (www.infoplease.com), *emphasis added.*] From this

definition, it is seen that a net magnetization exists in Saito's ferrimagnetic AP pinned layer structure.

In the Response to Arguments section of the Office Action, the Examiner argues that Saito paragraph [0017] teaches that the magnetic moment of the first pinned magnetic layer 112 cancels the magnetic moment of the second pinned magnetic layer 114. Applicant's position is that of course the moment of layer 112 cancels the moment of layer 114; the moment of layer 112 is larger. However, because the moment of layer 112 is larger, there must be a net moment. It appears that the Examiner is erroneously equating a zero net magnetic moment with the fact that a larger moment will cancel a smaller moment. But what the Examiner has failed to consider is what happens to the additional moment of the larger layer. Applicant's position is that because one of the moments is larger, there must be a net moment. The calculation of a net moment can be calculated by the following equation: Moment1 – Moment2 = Net Moment. Applicant respectfully requests that the Examiner particularly point out how a Net Moment can be substantially equal to zero when Moment1 is significantly larger than Moment2, as shown in FIG. 30 of Saito. (FIG. 30 is referred to in Saito paragraph [0017], as relied on in the rejection).

In the Response to Arguments section of the Office Action, the Examiner also argues that the net magnetic moment is a spontaneous magnetic moment, which is known in the art as a tiny amount. However, no support for the definition of a "spontaneous magnetic moment" has been provided, and so Applicant requests a showing of support for this officially noticed fact.

Also, Saito indicates that a few magnitude of spontaneous magnetization remains. A "few magnitude" indicates that more than just a single, tiny amount of magnetic moment is present, as asserted by the Examiner.

In the Response to Arguments section of the Office Action, the Examiner also argues that a net magnetic moment is necessary for a pinned layer structure to work. If that is so, then Applicant's structure with a net magnetic moment substantially equal to zero is truly different than the art.

In the Response to Arguments section of the Office Action, the Examiner also argues that Applicant has purposely made the net magnetic moment not zero so that the AFM will keep the net moment from flipping. This is not so. The AFM layer stabilizes the pinned layers so that the magnetic orientations of the pinned layers themselves are less prone to flipping, regardless of whether the AP pinned layer structure has a net moment or not.

Accordingly, it cannot be said that Saito teaches or suggests an AP pinned layer structure having a net magnetic moment of about zero as claimed. Because not all claim limitations 1-34, particularly as amended, would be improper as failing the third element of the *Graham* test. Reconsideration and allowance of claims 9-34 is respectfully requested.

Regarding claims 18-32 and 34, Applicant respectfully traverses the rejection as failing the first and third prongs of the *Graham* test.

Regarding the first and third prongs of the *Graham* test, those of suggesting the proposed modification and of teaching or suggesting all claim limitations, Applicant first notes that the claimed range for the antiferromagnetic layer thickness is about 50-100Å. The rejection indicates that because Pinarbasi discloses an "exemplary" PtMn thickness of 30Å, this implies that the thickness is variable. The rejection also notes that Pinarbasi discloses a 150Å AFM layer (332). However, this AFM layer 332 (Fig. 11) pins the pinned layer 328, not the AP coupled layers 314, 316. *See also* layer 248 of Pinarbasi's Fig. 10, which pins pinned layer 244. Thus, Pinarbasi's AFM layer 332 has no relevance to examination of the claims. It does not suggest anything relating to pinning the AP pinned layer structure.

For the only relevant AFM layer disclosed in Pinarbasi, seed layer 216, the lower end of the claimed range (50Å) is almost *twice as thick* as Pinarbasi's exemplary thickness. The upper end of the claimed range (100Å) is *over three times as thick* as Pinarbasi's exemplary thickness. It is simply too far of a stretch to say that Pinarbasi's 30Å AFM layer can be varied to meet the claimed 50-100Å AFM layer.

Nor has the Examiner provided a reasonable motivation based on knowledge generally available to those skilled in the art and not provided by Applicant in the present disclosure.

> "To support the conclusion that the claimed invention is directed to obvious subject matter, either the references must expressly or impliedly suggest the claimed invention or the examiner must present a convincing line of reasoning as to why the artisan would have found the claimed invention to have been obvious in light of the teachings of the references." Ex parte Clapp, 227 USPQ 972, 973 (Bd.Pat.App.&Inter.1985).

Here, the Examiner has indicated that the motivation to modify Pinarbasi is based on experimentation. However, as pointed out below, Pinarbasi actually suggests that the thickness of the PtMn seed layer 216 not vary. As substantive proof that Pinarbasi does not suggest that AFM layer 216 be thicker than 30Å, the Examiner is directed to Pinarbasi paragraph 0042, which states: "The seed layer structure **208** may include first, second, third and fourth seed layers (SLl), (SL2), (SL3) and(SL4) **210, 212, 214** and **216.** The seed layers, with the thicknesses and materials shown, have been found to promote a desirable texture of the layers deposited thereon." Pinarbasi indicates that the thickness shown (30Å) is important to formation of layers thereon, and so does not suggest that the thickness is variable. Presumably, one skilled in the art would not attempt to double the seed layer thicknesses, given that Pinarbasi has presented properties that work well. Thus, the only conclusion that can be drawn is that the combination of features proposed in the rejection has been impermissibly drawn from Applicant's disclosure.

The law supports Applicant's position. The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills,* 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). Although a prior art device "may be capable of being modified to run the way the apparatus is claimed, there must be a suggestion or motivation in the reference to do so." 916 F.2d at 682, 16 USPQ2d at 1432.). The

suggestion or motivation to modify Pinarbasi's AFM seed layer is simply not present in the combination of references proposed in the rejection. As substantive proof that Pinarbasi does not suggest that AFM layer 216 be thicker than 30Å, the Examiner is directed to Pinarbasi paragraph 0042, which states: "The seed layer structure **208** may include first, second, third and fourth seed layers (SL1), (SL2), (SL3) and(SL4) **210, 212, 214** and **216.** The seed layers, with the thicknesses and materials shown, have been found to promote a desirable texture of the layers deposited thereon." Pinarbasi indicates that the thickness shown (30Å) is important to formation of layers thereon, and so does not suggest that the thickness is variable.

In fact, it appears from paragraph 0042 that Pinarbasi actually teaches away from varying the thickness of AFM layer 216. A *prima facie* case of obviousness may also be rebutted by showing that the art, in any material respect, teaches away from the claimed invention. *In re Geisler*, 116 F.3d 1465, 1471, 43 USPQ2d 1362, 1366 (Fed. Cir. 1997). Again, Pinarbasi indicates that the "seed layers, with the thicknesses and materials shown, have been found to promote a desirable texture of the layers deposited thereon." Pinarbasi indicates that the thickness shown (30Å) is important to formation of layers thereon. Per the rule of *In re Geisler*, *supra*, the rejection is erroneous.

For any of these reasons, the rejection fails the first and third prongs of the *Graham* test. Reconsideration and allowance of claims 18-32, 34 is respectfully requested.

In the event a telephone conversation would expedite the prosecution of this application, the Examiner may reach the undersigned at (408) 971-2573. For payment of any additional fees due in connection with the filing of this paper, the Commissioner is authorized to charge such fees to Deposit Account No. 50-2587 (Order No. HSJ920030118US1).

Respectfully submitted,

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